

Aerodynamics Design of the Huygens Spin Vanes for the HASI

M. Antonello

(1) CISAS "G.Colombo" - Universit  di Padova, via Venezia 1, 35131 Padova, Italy

email: antonello@dim.unpd.it

The methodology adopted for the design of the Huygens spin vanes for the HASI balloon flight campaign is presented. In order to respect the prescribed mission values of the spin velocity profile during the descent through Titan atmosphere, a configuration of the axial cascade, different from the original one, must be chosen. In the preliminary design the aerodynamics forces on the vanes has been evaluated using the theory of two-dimensional flow through cascade described in [1]. The final configuration of the vanes has been obtained by numerical simulations of the three dimensional turbulent flow around the probe. The descent law of the probe has been used to calculate the vertical velocity of the inlet boundary condition. The simulations has been performed for a wide set of horizontal wind condition that can be occur during the descent through hearth atmosphere in Sicily. The instantaneous probe rotation has been evaluated from the pressure field around the vanes supplied by the numerical code at each time step. The turbulent flow transport equations has been solved using the explicit algebraic Reynolds stress method described in [2] in conjunction with the standard transport equation of the turbulent kinetic energy end the dissipation rate of turbulent kinetic energy.

References:

- [1] Scholz N., Aerodynamics of Cascade. AGARD-AG-220, 1977.
- [2] Gatski, T.B., Speziale, C.G.. On explicit algebraic stress models for complex turbulent flows. J. Fluid Mech. 254, 59-78, 1993.